1,168,489

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,168,489

Date of filing Complete Specification (under Section 3 (3) of the Patents Act 1949): 4 March, 1968.

Date of Application (No. 55237/66): 9 December, 1966.

Two Applications (Nos. 34228/67 and 34229/67) Dated: 26 July, 1967.

Complete Specification Published: 29 October, 1969.

Index at Acceptance:—F1 H (13, 22, 25); F4 T (G10A, G10C, G20, G26).

International Classification:—F 01 b 25/16.

COMPLETE SPECIFICATION

Fuel Supply Systems of Fuel-Injection Pumps of Internal Combustion Engines and of Oil Burners

I, FREDERICK ARTHUR DRIVER, British Subject, of Sunnyside Cottage, County Lane, Kingswood, Albrighton, Wolverhampton, Staffordshire, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly

ERRATUM

SPECIFICATION NO. 1,168,489

Page 1, Index at acceptance *for* "F1 H" *read* "F1 K"

THE PATENT OFFICE,
27 November 1969

D 120236/15

the burner put out of action in the event of fuel failing to reach the feed pump. It can also be arranged that the filter remains full of fuel and the injector or burner pump remains flooded and free of air when the engine or burner is stopped from operating, so as to be in a condition for immediate re-starting when the fuel supply is restored.

According to the invention, a liquid-fuel supply system of an internal combustion engine or oil-burner wherein a feed pump is arranged to deliver fuel from a main fuel supply tank through a main filter to an injection pump, is characterised in that the fuel supply line intermediate the feed pump and said injection pump is connected to an auxiliary reservoir tank or chamber containing a float associated with a float-controlled air vent which closes when said auxiliary reservoir tank or chamber is filled to a predetermined level by the fuel supplied by the feed pump, whereby a fluid pressure is produced in said reservoir tank or chamber during normal functioning of the system, and a pressure-sensitive cut-out device, responsive to said fluid pressure, is provided which is adapted to operate control means operative to stop the engine or to extinguish the burner in the event of a reduction or loss of said fluid pressure caused by fuel failing to reach the feed pump.

Preferably, the auxiliary reservoir tank or chamber is connected in series with the

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ping the operation of the engine or burner in the event of the supply of fuel failing.

The movable member of the cut-out device may be normally moved to a position such as to maintain the engine or burner in operation, by gaseous pressure acting on the fuel in the auxiliary reservoir tank or chamber, the arrangement being such that in the event of fuel failing to reach the feed pump, the said gaeous pressure will be released so that the movable member will move to a position in which it acts to stop the operation of the engine or burner.

Figure 1 of the accompanying drawings shows, diagrammatically, one embodiment of the invention in connection with the supply of fuel to a fuel-injection pump of an internal combustion-engine.

Figure 2 show, also diagrammatically, an alternative form of the invention.

Figure 3 represents another form of the invention in which an electrical cut-out device is employed.

Referring to Figure 1 of the drawings, the supply system comprises a feed or lift

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This invention relates to the liquid-fuel supply system of an internal combustion engine or oil burner wherein a feed pump is arranged to deliver fuel from a main fuel supply tank through a main filter to an injection pump.

An object of the present invention is to ensure that the engine will be stopped or the burner put out of action in the event of fuel failing to reach the feed pump. It can also be arranged that the filter remains full of fuel and the injector or burner pump remains flooded and free of air when the engine or burner is stopped from operating, so as to be in a condition for immediate re-starting when the fuel supply is restored.

According to the invention, a liquid-fuel supply system of an internal combustion engine or oil-burner wherein a feed pump is arranged to deliver fuel from a main fuel supply tank through a main filter to an injection pump, is characterised in that the fuel supply line intermediate the feed pump and said injection pump is connected to an auxiliary reservoir tank or chamber containing a float associated with a float-controlled air vent which closes when said auxiliary reservoir tank or chamber is filled to a predetermined level by the fuel supplied by the feed pump, whereby a fluid pressure is produced in said reservoir tank or chamber during normal functioning of the system, and a pressure-sensitive cut-out device, responsive to said fluid pressure, is provided which is adapted to operate control means operative to stop the engine or to extinguish the burner in the event of a reduction or loss of said fluid pressure caused by fuel failing to reach the feed pump.

Preferably, the auxiliary reservoir tank or chamber is connected in series with the fuel supply line and also acts to trap any air carried along with the fuel from the feed pump.

The said cut-out device may comprise a chamber into which the fuel or pressurised air from the aforesaid auxiliary reservoir tank or chamber can enter, and a spring-loaded movable member therein, such as a flexible diaphragm or piston, on which the fluid pressure acts, said movable member being operable upon control means for stopping the operation of the engine or burner in the event of the supply of fuel failing.

The movable member of the cut-out device may be normally moved to a position such as to maintain the engine or burner in operation, by gaseous pressure acting on the fuel in the auxiliary reservoir tank or chamber, the arrangement being such that in the event of fuel failing to reach the feed pump, the said gaeous pressure will be released so that the movable member will move to a position in which it acts to stop the operation of the engine or burner.

Figure 1 of the accompanying drawings shows, diagrammatically, one embodiment of the invention in connection with the supply of fuel to a fuel-injection pump of an internal combustion-engine.

Figure 2 show, also diagrammatically, an alternative form of the invention.

Figure 3 represents another form of the invention in which an electrical cut-out device is employed.

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SEE ERRATA SLIP ATTACHED

pump 1 for raising liquid fuel from a main fuel tank (not shown) and supplying it to an injection pump 2 through a main filter 3.

The fuel line 4 from the feed pump 1 is taken to an auxiliary reservoir tank or vessel consisting of a float chamber 5 having in its top cover 6 an aperture 7 connected by a pipe line 8 to a cut-out device 9 which is hereinafter described. The bottom of the float chamber 5 is connected by a pipe 10 to one side of the main filter 3 which is connected by a pipe 11 to the injection-pump 2.

The chamber 5 contains a float 12 normally urged downwardly by a buoyancy bias spring 13 acting on a lever arm 14 controlling an air vent valve 15, the said valve being closed when the float 12 is raised by the fluid to a predetermined level, but being opened to atmosphere when the float falls below the said level.

The cut-out device 9 comprises a chamber 16 divided interiorly by a transversely-extending flexible diaphragm 17 into two compartments, namely, on the one side of the diaphragm a pressure compartment 18 to which the pipe line 8 from float chamber 5 is connected, and, on the other side of the diaphragm, a compartment 19 suitably vented to atmosphere. The diaphragm 17 is clamped between two halves of the casing, and attached to it at the centre is a horizontal spindle 20 extending through the compartment 19 and being slidably mounted in a bearing 21 supported by a wall of the casing. A coiled compression spring 22 acts on the diaphragm 17 so as to tend to deflect the latter into the pressure compartment 18.

The outer end of the spindle 20 is jointed at 23 to a lever 24 pivoted at 25 to a bracket 26 and whose lower end is jointed to a rod 27 connected to the injection-pump control arm 28. The rod 27 is extended in a direction away from the control arm 28 to form a manual over-ride device 29 by which the injection-pump may be controlled manually independently of its control by the cut-out device 9.

The operation of the system is as follows:—

When the feed pump 1 delivers fuel to the filter 3 and injection-pump 2, the float chamber 5 will begin to fill up and the float will rise, air being displaced through the open vent valve 15 until the float reaches a certain level at which the said valve 15 closes. The upper part of the float chamber is thus sealed off from atmosphere and as the fuel level continues to rise a cushioning pocket of air is trapped in the upper part of the chamber and is compressed until the pressure builds up to balance the maximum delivery pressure of the feed pump 1. This air pressure in the upper part of the float chamber is transmitted through pipe line 8 to the pressure compartment 18 of the cut-out device 9 and acts on the diaphragm 17 so as to cause it to deflect and move against the resistance of the spring 22, thereby operating the lever 24 and, through rod 27, the control arm 28 of the injection-pump, in a manner such as will cause the engine to operate. During the filling of float chamber 5 any air carried along with the fuel from feed pump 1 will be trapped in the upper part of the latter and exhausted through the vent valve 15 or compressed by the rising level of fuel and discharged through pipe 8.

The float chamber 5 is connected in series with the fuel supply line and precedes the filter 3 and injection-pump 2. During running of the engine fuel flows from chamber 5 through pipes 10,11, and further fuel enters the chamber through pipe 4 from the feed pump so as to maintain its level and the air pressure within the chamber 5, the vent valve 15 remaining closed.

If, however, fuel fails to reach the feed pump 1, fuel will continue to leave the chamber 5 by pipe 10 until the float 12 falls to a position in which the vent valve 15 opens so that the air pressure above the fuel level in the float chamber is then released, thereby relieving the air pressure on the pressure side of the diaphragm 17 of the cut-out device. The spring 22 then acts so as to return the diaphragm to its initial position and move the lever 24, rods 21 and control arm 28 to positions which cause the engine to be stopped.

The filter 3, injection pump 2, and fuel supply pipe from the float chamber 5 therefore remain flooded with fuel and thus free of air. Upon the fuel supply being restored by the feed pump 1, any air remaining in the said feed pump, or in the pipe line 4, will pass into and be trapped in the top of the float chamber 5 and will then be compressed in due course by the rising level of fuel on restoration of the fuel supply.

The manual over-ride device 29 enables the engine to be re-started and to run for a short time, utilising fuel from the float chamber 5, although the air pressure has fallen below the value at which the cut-out device operates. Thus, by moving the over-ride extension rod to the right, and holding it against the biassing force exerted by the spring 22, the engine of a vehicle may be re-started and run for a short period which in many cases may be sufficient for the vehicle to be moved to a more convenient or safer position, still without causing air to enter into the main filter and injector pump supply line.

The arrangement described is designed so that under normal fuel feed conditions, if tilting of the vehicle occurs beyond a pre-

determined critical angle, or the vehicle overturns, the spring-biassed float 12 will lose its buoyancy support and the spring 13 will move it into a position in which the air vent valve 15 is opened, thereby leading to a loss of pressure in the reservoir or float chamber 5 and the consequent operation of the cut-out device to stop the engine. The float may be biassed by a weight instead of by a spring.

Means controlled by the flow of fuel to the feed pump may be incorporated for introducing from an external source compressed air or gas into the space above the fuel level in the reservoir in order to maintain the operational pressure for the running of the engine so long as fuel is being supplied to the feed pump. In the modification illustrated in Figure 2, the cut-out device 9 is introduced into the pipe line between the float chamber 5 and the main filter 3. Thus, the upper end of the float chamber 5 is closed, but a pipe 30 leads from its lower end into the pressure compartment 18 of the cut-out device, whilst another pipe 31 leads from said compartment to the filter 3 which is connected by pipe 11 to the injection-pump 2. The chamber 5 contains float 12 biassed by spring 13 acting on lever 14 controlling the vent valve 15, as in Figure 1, and the diaphragm 17 of the cut-out device acts on the spring-loaded spindle 20 connected to lever 24 operating rod 27 and control arm 28, with manual over-ride device 29, also as in Figure 1.

The operation of the arrangement shown in Figure 2 is that as fuel is supplied from feed pump 1 by pipe 4 to the filter 3 and injection pump 2 through reservoir float chamber 5 and pressure compartment 18 of the cut-out device, the float 12 rises to close vent valve 15 and air pressure builds up above the float as in the arrangement of Figure 1. This air pressure acts on the fuel in chamber 5 and since the latter is connected by pipe 30 to the pressure compartment 18 of the cut-out device, the said fluid pressure is transmitted to the diaphragm 17 which is thereby deflected to operate lever 24 and control arm 28 in order to bring the engine into operation, as in the Figure 1 arrangement. If the fuel fails to reach the feed pump 1, the level of fuel in chamber 5 will fall and the float 12 will descend so as to open vent valve 15, thus releasing the air pressure, causing the diaphragm 17 to return to its initial position and the engine to stop. A manual over-ride extension 29 of rod 27 is provided as in Figure 1.

The arrangement in Figure 3 is as in Figure 1, but instead of a mechanical cut-out device, an electrical device is provided. Thus the feed pump 1 supplies fuel through pipe 4 to float chamber 5 containing spring-biassed float 12 and vent valve 15, and connected at its lower end by pipe 10 to main filter 3, as in Figure 1, but in place of the mechanical cut-out device 9 of the Figure 1 arrangement, the compressed air in the top of chamber 5 acts, through aperture 7, upon an electric pressure switch 32 which closes an electric circuit 33 from a battery and thereby energises a solenoid 34 which axially moves a core 35 connected to the control arm 28 of the injection pump 2 as well as to a manual over-ride rod 29 to enable the control arm 28 to be operated by hand, as in the arrangement of Figures 1 and 2.

It is to be understood that in the cut-out devices of Figures 1 and 2, a spring-loaded sliding piston may be employed in place of the diaphragm 17, the piston rod being connected to or associated with the engine stopping means.

The application of the invention to the supply system of a fuel injection pump of a fuel oil burner for boilers and furnaces differs in no essential respect from its application to a supply system of a fuel-injection pump of an internal combustion engine as hereinbefore described, the operation of the cut-out device controlling the operation of the burner which would be automatically put out of action if fuel ceases to be delivered by the lift pump.

WHAT I CLAIM IS:—

1. A liquid-fuel supply system of an internal combustion engine or oil-burner wherein a feed pump is arranged to deliver fuel from a main fuel supply tank through a main filter to an injection pump, characterised in that the fuel supply line intermediate the feed pump and said injection pump is connected to an auxiliary reservoir tank or chamber containing a float associated with a float-controlled air vent which closes when said auxiliary reservoir tank or chamber is filled to a predetermined level by the fuel supplied by the feed pump, whereby a fluid pressure is produced in said reservoir tank or chamber during normal functioning of the system, and a pressure-sensitive cut-out device, responsive to said fluid pressure, is provided which is adapted to operate control means operative to stop the engine or to extinguish the burner in the event of a reduction or loss of said fluid pressure caused by fuel failing to reach the feed pump.

2. A liquid-fuel supply system as claimed in claim 1 wherein the float-containing auxiliary reservoir tank or chamber is connected in series with the fuel supply line whereby it also acts to trap any air carried along with the fuel passing through.

3. A liquid-fuel supply system as claimed in claim 1, wherein the feed pump is connected by a pipe line to the upper part of the float-containing auxiliary reservoir tank

or chamber from the lower portion of which a delivery pipe supplies fuel to the main filter and to the injection pump, said float causing the air vent to close at a predetermining level of fuel so that air above the fuel is trapped in the upper part of the reservoir tank or chamber and is compressed therein, said compressed air being rendered operative, either directly or through the medium of the fuel in the said reservoir tank or chamber, upon the pressure-sensitive cut-out device.

4. A liquid-fuel supply system as claimed in claim 2 or 3, wherein the upper part of the auxiliary reservoir tank or chamber is connected by a pipe line to the cut-out device.

5. A liquid-fuel supply system as claimed in claim 2 or 3, wherein the cut-out device is connected in the fuel supply line leading from the auxiliary reservoir tank or chamber.

6. A liquid-fuel supply system as claimed in any preceding claim, wherein the cut-out device comprises a chamber into which the fuel or pressurised air can enter and a spring-loaded movable member therein on which the fluid pressure can act, said movable member being operable upon control means for stopping the operation of the engine or burner in the event of the supply of fuel failing.

7. A liquid-fuel supply system as claimed in claim 6, wherein the movable member of the cut-out device is normally moved to a position such as to maintain the engine or burner in operation, by gaseous pressure acting on the fuel in the auxiliary reservoir tank or chamber, the arrangement being such that in the event of fuel failing to reach the feed pump, the said gaseous pressure will be released so that the movable member will move to a position in which it acts to stop the operation of the engine or burner.

8. A liquid-fuel supply system as claimed in claim 6 or 7, wherein the movable member of the cut-out device consists of a flexible diaphragm or sliding piston.

9. A liquid-fuel supply system as claimed in any one of the preceding claims, wherein the cut-out device operates a control arm of the injection pump through the medium of mechanical connecting means.

10. A liquid-fuel supply system as claimed in claim 2 or 3, wherein the cut-out device comprises an electrical pressure switch upon which the air pressure in the upper part of the reservoir chamber acts and which controls an electrical circuit containing a solenoid which actuates a control arm of the injection pump.

11. A liquid-fuel supply system of an internal combustion engine as claimed in any one of the preceding claims, wherein a manual over-ride device is provided connected to a control member of the injection pump whereby said pump may be operated by hand to re-start the engine, independently of the control by the cut-out device, by utilising fuel from the auxiliary reservoir tank or chamber.

12. A liquid-fuel supply system of an internal combustion engine as claimed in any one of the preceding claims, wherein the float in the auxiliary reservoir tank or chamber is biassed by a spring or weight towards the bottom of said reservoir, whereby in the event of the reservoir being tilted beyond a predetermined angle from the vertical, the float will lose its buoyancy support, causing the air vent to be opened and the cut-out to stop the engine.

13. A liquid-fuel supply system of an internal combustion engine or oil-burner substantially as herein described with reference to Figure 1, Figure 2, or Figure 3 of the accompanying drawings.

H. N. & W. S. SKERRETT,
24, Temple Row,
Birmingham 2.
Agents for Applicant.

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1,168,489
3 SHEETS

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

SHEET 1

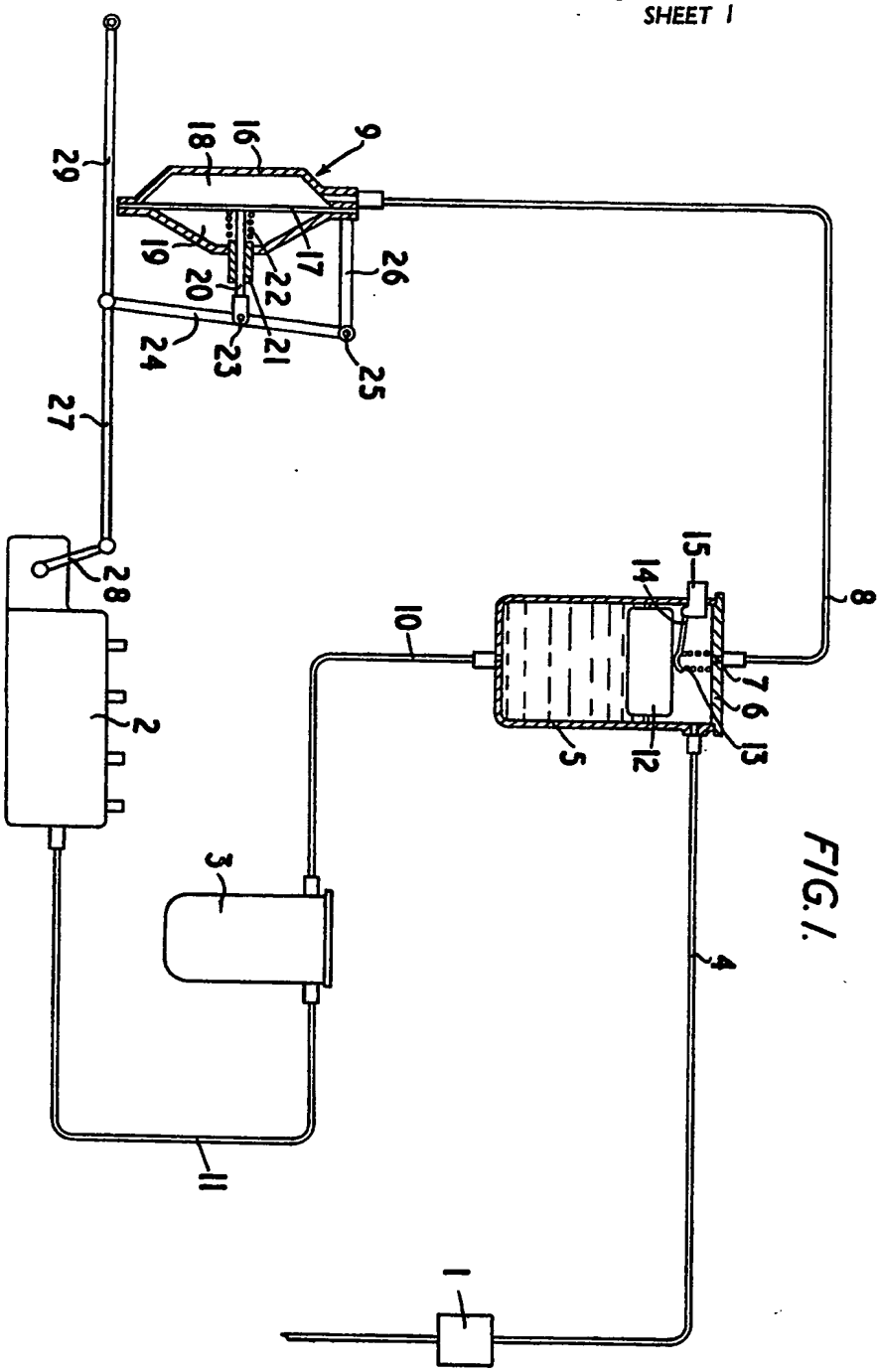

FIG. 1.

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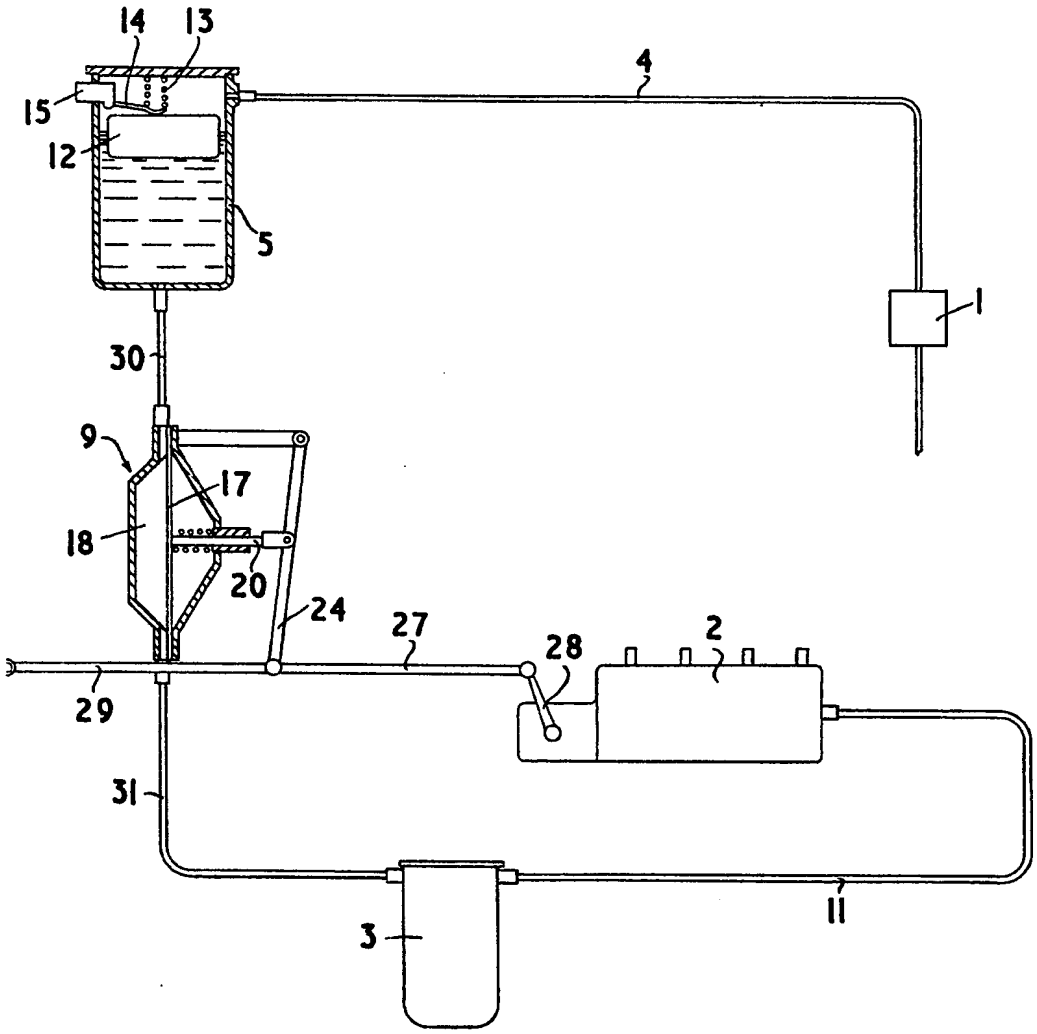
SHEET 2

FIG. 2.



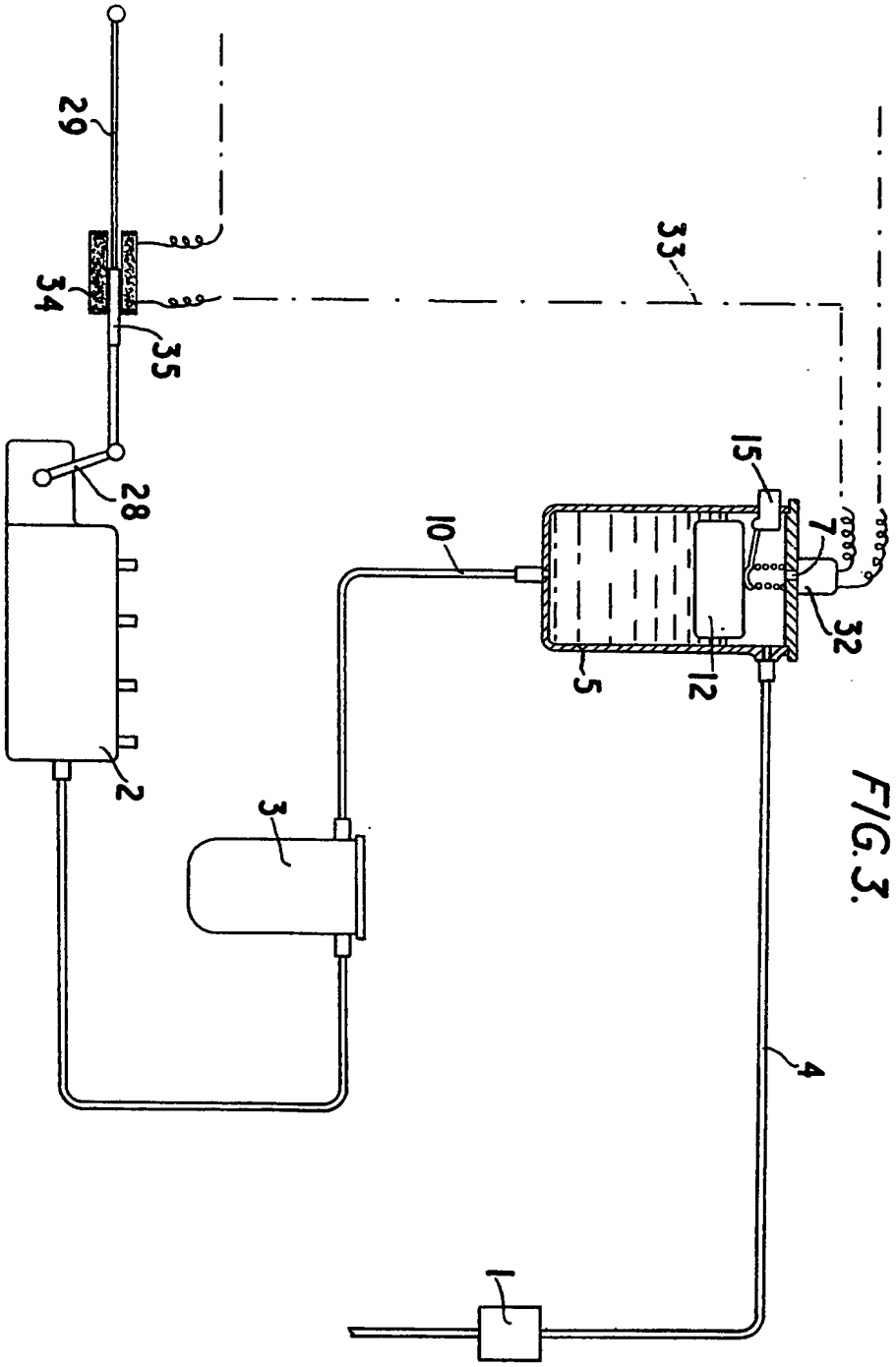


FIG. 3.